

Nutrient & Manure Management Tables



Table 1. Annual Manure Production and Nutrient Excretion from Livestock

Animal Type	Manure Production per 1,000 lbs. of Animal Weight		Excreted Nutrients in Manure per 1,000 lbs. of Animal Weight		
	SOLID tons/year	LIQUID gal./year	N lbs./year	P2O5 lbs./year	K2O lbs./year
BEEF CATTLE					
Calf	19.5	4,591	162	73	130
Finishing	9.0	2,141	131	39	83
Cow	16.8	3,982	128	66	106
DAIRY CATTLE					
Calf	14.6	3,358	146	24	122
Heifer	11.0	2,536	112	39	112
Lactating	20.3	4,876	263	135	146
Dry Cow	9.3	2,241	110	40	88
Veal	4.8	1,153	44	29	73
SWINE					
Nursery	13.9	3,358	292	146	146
Finishing	9.0	2,166	219	73	97
Gestating Sow	4.1	998	61	37	49
Lactating Sow	8.5	2,025	165	107	127
Boar	3.8	900	49	37	37
POULTRY					
Layer	9.1	2068	316	97	146
Broiler	17.3	4198	383	256	183
Turkey (F)	8.6	2044	285	186	124
Turkey (M)	6.8	1606	203	135	88
Duck	20.1	4836	392	310	237
HORSE					
Pleasure	9.9	2,394	66	22	22
"Racer"	10.1	2,446	110	55	84
SHEEP					
Feeder	7.5	1,825	146	73	146

Adapted From: Manure Characteristics, MWPS-18 Section 1, Midwest Plan Service, 2004 Second Edition

Table 2. Nitrogen Losses From Animal Manure as Affected by Method of Handling and Storage

Manure Storage and Handling method	Manure Type	% Storage Nitrogen Loss
Daily Scrape and Haul	Solid (tons)	25
Manure Pack	Solid (tons)	30
Open Lot	Solid (tons)	50
Litter	Solid (tons)	35
Above ground tank	Liquid (gallons)	20
Below ground covered pit	Liquid (gallons)	20
Below ground open pit	Liquid (gallons)	25
Under-floor Dry storage	Solid (tons)	25
Under-floor Liquid Storage	Liquid (gallons)	20
Earthen Storage	Liquid (gallons)	30
Lagoon	Liquid (gallons)	75

Adapted From: Animal Manure as a Plant Nutrient Source, ID-101, Cooperative Extension Service, Purdue University, 2001

Table 3. Nutrient Content of Stored Manure

Animal Type	Liquid Manure (lbs/1000 gallons)			Solid Manure (lbs/Tons)		
	N	P2O5	K2O	N	P2O5	K2O
BEEF						
Feeder Cattle	29	18	26	14	9	14
Cows	20	16	24	11	7	9
DAIRY						
Heifers	32	14	28	13	12	19
Cows	25	15	27	11	7	9
SWINE						
Farrowing	27	27	15	14	6	4
Nursery	34	25	18	13	8	4
Finishing	53	39	29	22	22	17
Gestation	40	42	18	22	27	14
POULTRY						
Layers	57	52	33	39	57	34
Broilers	63	40	29	59	63	40
Turkey	53	40	29	44	63	34
HORSE						
				14	4	14
SHEEP						
				18	11	26

Manure Management in Minnesota, FO-3553-C, University of Minnesota Extension Service, 2007
Manure Characteristics, MWPS-18 Section 1, Midwest Plan Service, 2000
Livestock Waste Facilities Handbook, MWPS-18, Midwest Plan Service, 1985

Table 4. Nitrogen Availability and Loss as Affected by Method of Manure Application and Animal Species

Year Available (1)	% of Total Nitrogen Available Per Year				
	Broadcast Incorporation Time (2)			Injection	
	> 96 hrs	12-96 hrs.	<12 hrs.	Sweep	Knife
BEEF					
Year 1	25	45	60	60	50
Year 2	25	25	25	25	25
Lost	40	20	5	5	10
DAIRY					
Year 1	20	40	55	55	50
Year 2	25	25	25	25	25
Lost	40	20	10	5	10
SWINE					
Year 1	35	55	75	80	70
Year 2	15	15	15	15	15
Lost	50	30	10	5	15
POULTRY					
Year 1	45	55	70	NA	NA
Year 2	25	25	25	NA	NA
Lost	30	20	5		

From: Manure Planning and Record Keeping Guide, BU-6957, U of M Extension Service, 2001

(1) 3rd year available N is not listed but can be computed by adding 1st and 2nd year and lost percentages and subtracting this sum from 100.

(2) Timing categories refer to the length of time between manure application and incorporation.

Calibrating Your Manure Spreader

- Determine manure weight (solid manure) or manure volume (liquid manure) per spreader load (Use measured manure weight or 90% of the manufacturer's listed volume for liquid)
- Calculate rate based on loads applied per field **OR** calculate rate based on acres covered per load (Length x Width of Spread (ft.²)/43,560)



Table 5. Nutrient Removal in the Harvested Portion of the Crop

Crop	Crop Nutrient Removal (lbs. per unit)			
	Yield Units	N	P2O5	K2O
Alfalfa	ton (air dry)	50	11	46
Alsike clover	ton (air dry)	41	11	54
Barley (grain)	bushel		0.41	0.28
Barley (grain & straw)	bushel		0.55	1.67
Birdsfoot trefoil	ton (air dry)	45	9.3	41
Canola	cwt		1.3	1.1
Corn (grain)	bushel		0.34	0.19
Corn silage	ton (as fed)		3.8	7.4
Edible beans	pound		0.01	0.03
Grass hay or pasture	ton (air dry)	27	8.9	31
Grass/Legume	ton (air dry)	44	11	41
Oats (grain)	bushel		0.25	0.16
Oats (grain & straw)	bushel		0.32	1.31
Peas	pound		0.01	0.01
Potatoes	cwt		0.14	0.56
Red Clover	ton (air dry)	45	11	41
Rye (grain)	bushel		0.44	0.31
Rye (grain and straw)	bushel		0.59	1.25
Soybeans	bushel	3.5	0.82	1
Sugar beets	ton		2.2	7.3
Sunflowers	pound		0.01	0.01
Sweet Corn	ton		11	14
Wheat (grain)	bushel		0.53	0.3
Wheat (grain & straw)	bushel		0.64	1.5

Source: Plants Database, USDA (<http://npk.nrcs.usda.gov>)

Legume Nitrogen Credits

For Corn, Wheat, and Barley grown the 1st and 2nd year after a legume crop

Legume (Previous Crop)	Corn		Wheat & Barley	
	1st year	2nd year	1st year	2nd year
Soybeans	40	0	20	0
Edible Beans	20	0	10	0
Field Peas	20	0	10	0
Harvested Sweet Clover	20	0	10	0
Harvested Alfalfa or nonharvested Sweet Clover (plants/ft 2)				
4 or more	150	75	75	35
2-3	100	50	50	25
1 or less	40	0	0	0
Red Clover	70	35	35	20

Common Fertilizer Analyses

Example to figure fertilizer price per pound:

Urea (46-0-0) = \$400/Ton
 (2000 lbs. x .46% N) = 920 lbs. N/Ton
 \$400 / 920 lbs. = \$0.43 per pound

Fertilizer	Analysis
N	
Anhydrous Ammonia	82-0-0
Ammonium Nitrate	34-0-0
Urea	46-0-0
UAN Solution (Urea Ammonium Nitrate)	28 to 32-0-0
Ammonium Sulfate	21-0-0-24 (S)
P	
Triple Superphosphate (TSP)	0-44 to 0-46
Diammonium phosphate (DAP)	18-46-0
Monoammonium phosphate (MAP)	11-52-0
Ammonium Polyphosphate Liquid (APP)	10-34-0
Ammonium Polyphosphate Dry (APP)	15-62-0
K	
Potassium Chloride (Muriate of potash)	0-0-60
Potassium Sulfate	0-0-50-18 (S)
Potassium-Magnesium Sulfate (Sul-fo-mag)	0-0-22-22S-11(Mg)
Potassium Nitrate	13-0-44



Nitrogen Sources Per Pound Conversions

Anhydrous Ammonia (82-0-0)		Urea (46-0-0)		UAN (28-0-0)	
Price per Ton	N Price per. lb	Price per Ton	N Price per. lb	Price per Ton	N Price per. lb
200	\$0.12	210	\$0.23	100	\$0.18
250	\$0.15	245	\$0.26	125	\$0.23
300	\$0.19	280	\$0.30	150	\$0.27
350	\$0.22	315	\$0.34	175	\$0.32
400	\$0.25	350	\$0.38	200	\$0.36
450	\$0.28	385	\$0.42	225	\$0.40
500	\$0.30	420	\$0.46	250	\$0.45
550	\$0.34	455	\$0.49	275	\$0.49
600	\$0.37	490	\$0.53	300	\$0.54
650	\$0.40	525	\$0.57	325	\$0.58
700	\$0.43	560	\$0.61	350	\$0.63
750	\$0.46	595	\$0.65	375	\$0.67
800	\$0.49	630	\$0.68	400	\$0.71
850	\$0.52	665	\$0.72	425	\$0.76
900	\$0.55	700	\$0.76	450	\$0.80
950	\$0.58	735	\$0.80	475	\$0.85
1,000	\$0.61	770	\$0.84	500	\$0.89

Conversion Factors

1 ton = 2,000 lbs.
1 acre = 43,560 sq. ft
1 cubic ft. = 7.48 gallons
1 gallon of water = 8.33 lbs.
SOIL TESTING CONVERSIONS
Plow Layer (6-7 in) = ppm X 2 = lbs/acre
Top 12 inches = ppm X 4 = lbs/acre
Top 24 inches = ppm X 8 = lbs/acre
P2O5 X 0.44 = P
P X 2.29 = P2O5
K2O X 0.83 = K
K X 1.20 = K2O
FERTILIZER CONVERSIONS
1 gal. of UAN (28%) = 10.66 lbs
1 gal. (10-34-0) = 11.65 lbs
1 gal. (7-21-7) = 11.0 lbs
1 gal. (9-18-9) = 11.11 lbs.

Nutrient Management Related Websites

Certified Manure Testing Laboratories: <http://www2.mda.state.mn.us/webapp/lis/manurelabs.jsp>

University of Minnesota Manure Management: <http://www.manure.umn.edu/>

Minnesota Department of Ag Manure Management: <http://www.mda.state.mn.us/protecting/conservation/practices/manuremgmt.aspx>

Minnesota NRCS Manure Management: <http://www.mn.nrcs.usda.gov/technical/ecs/nutrient/manure/manure.htm>

Nitrogen Best Management Practices (BMPs): <http://www.mda.state.mn.us/protecting/bmps/nitrogenbmps.aspx>

Nitrogen Rate Calculator: <http://extension.agron.iastate.edu/soilfertility/nrate.aspx>

Economics of Manure Management (U of M): <http://www.manure.umn.edu/applied/economics.html>